F **Fermilab**
Beams Division
NuMI Project

April 30, 2003

To: Greg Bock

From: Bob Ducar

Re: NuMI Project, Davis-Bacon Determinations (Revised)

The NuMI Project is a $171.4 million dollar effort that provides for the construction of an intense, variable energy, beam of neutrinos using the Fermilab Main Injector, as well as large underground neutrino detectors located at Fermilab and Soudan, Minnesota. The purpose of the Project is to enable a new generation of long baseline neutrino experiments that can decisively detect and accurately measure neutrino oscillations. Detection of such oscillations would firmly establish a non-zero value of neutrino mass. The scope of the NuMI Project includes the excavation of large underground spaces to house the neutrino beam system and associated near and far MINOS experimental detectors.

NuMI Project Management is fully aware of Davis-Bacon Act applicability to new construction and installation activities that are Federally funded and is committed to meet the letter and intent of the Act in its application to the NuMI Project.

This memorandum serves to outline the NuMI Project's request for Davis-Bacon determinations for three distinct broad areas of activity. These are 1) the construction of physical structures and excavation and outfitting of underground areas, 2) the installation of technical components (WBS 1.1) that comprise the neutrino beam system, and 3) the installation of the near MINOS experimental detector (WBS 2.5).

While the majority of construction and installation labor efforts afforded to the NuMI Project are designated for Davis-Bacon subcontract, there remain a limited number of specialized labor activities relative primarily to installation of technical components that are best designated as noncovered under Davis-Bacon. In distinguishing these activities, NuMI Project Management has used the following approach:

- If the craft skills required by the task in question are closely coupled with or normally used in the construction of the facility and installation of the system, the work is designated for Davis-Bacon subcontract. Examples include land surveying, excavation, concrete forming and construction, steel erection, interior cranes, electrical service installation, installation of fiber optic and electrical cables in communication ducts, installation of necessary technical equipment cabling between service buildings and the enclosure, termination of fiber optic cable and selected signal cabling, pipe fitting, welding, rigging, and HVAC installation.

- If the task represents a mixture of skill levels, some of which are normal crafts used in the construction and installation of a system, but others of which require technical professional staff, these tasks are best split into covered and non-covered by Davis-Bacon. Construction/subcontractor supervision and the NuMI LCW and RAW Systems are illustrative of such tasks.

- In cases where normal craft skills do not have adequate familiarity or expertise with the equipment or installation tasks, or where their inclusion in the tasks represents a substantial risk to continuity of operations or meeting physics goals, or where the performance of the task is procedurally or otherwise restricted, the task is best designated as non-Davis-Bacon. Such potential tasks are carefully examined, treated as narrow in scope, and kept to an absolute minimum. The final wiring and integration of the NuMI Radiation Safety System to the accelerator safety system is an example. The commissioning of the NuMI primary beamline is also an example.

In further distinguishing these activities, NuMI Project Management has relied on the criteria specifically set forth in Department of Energy Acquisition Regulations relative to particular work items that will normally be classified as noncovered by the Davis-Bacon Act. DEAR 970.2204-1-1(a)(3) allows as noncovered work the assembly, modification, setup, installation, replacement, removal, rearrangement, connection, testing, adjustment, and calibration of machinery and equipment. DEAR 970.2204-1-1(a)(4) allows as noncovered work the experimental development of equipment, processes, or devices including assembly, fitting, installation, testing, reworking, and disassembly.

The following briefly describes the general scope of work for various WBS categories together with selected installation activities for which Davis-Bacon exemption is sought. These activities are judged by NuMI Project Management to be suitable for designation as noncovered Davis-Bacon activities in light of the above criteria and precedent. On-going work activities on the part of Fermilab personnel related to supervision of covered Davis-Bacon work are not specifically listed. Verification of operability and commissioning activities are also not specifically listed. Estimates of hours of work required have been provided by WBS managers and are shown in parentheses. References to justifications are also included with each activity. In efforts to convey the overall magnitude of both covered and noncovered Davis-Bacon work activities, a summary table is provided at the end of this memorandum.

WBS 1.1.1 Primary Beam

Scope: This WBS is responsible for full installation of primary (proton) beam line from the extraction kicker in the Main Injector enclosure to the Target Hall, a distance of approximately 1500 feet. Included are 3 kicker magnets, 3 Lambertson magnets, 19 dipole magnets, 21 quadrupole magnets, and 19 trim elements. This WBS also includes instrumentation consisting of 24 beam position monitors, 12 multiwires, 2 beam intensity toroids, 55 loss monitors, and 4 total loss monitors. Mechanical stands and supports for this equipment are also included in this WBS.

Activities Requested for Designation as Noncovered Davis-Bacon:

Load testing of installed magnet stands (1C, 128 Hours)
Driving of magnet moving vehicle in the Main Injector enclosure (1B, 160 Hours)
Mechanical installation of 3 extraction kicker magnets (G3, 1A, 128 Hours)
Mechanical installation of flourinert cooling system for extraction kicker magnets (G3, 1A, 1D, 72 Hours)
Final installation and connection of instrumentation devices including BPMs, multiwires, beam toroids, and regular and total loss monitors. (G2, 480 Hours)

WBS 1.1.2 Neutrino Beam Devices

Scope: This WBS is responsible for nearly all of the technical components in the Target Hall. Components include the target and target baffle, magnetic focusing Horns 1 and 2, their modules and carriers, and Target Hall shielding and cooling. Scope also includes target and horn positioning systems, instrumentation, and radioactive component handling.

Activities Requested for Designation as Noncovered Davis-Bacon:

Install Target/Baffle module in beamline chase (G2, G3, G4, 160 Hours)
Install Horn 1 module assembly in beamline chase (G2, G3, G4, 160 Hours)
Install Horn 2 module assembly in beamline chase (G2, G3, G4, 160 Hours)
Install cross hair detector system in beamline chase (G2, G3, G4, 152 Hours)
Installation and testing of seals between concrete covers of beamline chase (G2, G3, G4, 160 Hours)
Development and practice of radioactive component handling (G3, 2A, 910 Hours)

WBS 1.1.3 Power Supplies

Scope: Responsible for DC, ramped and pulsed power supplies or power supply systems for extraction kickers, magnets, trim elements, magnetic focusing horns, and the horn current stripline. Also responsible for the high current stripline connecting the Horn PS to Horns 1 and 2.

Activities Requested for Designation as Noncovered Davis-Bacon:

Final construction, modification and assembly of thirty (30) instances of power supplies in service buildings including those for the kicker, dipole and quadrupole magnets (3A, 720 Hours)
Final connection and certification of forty-eight (48) instances of cabling between power supplies and loads including: extraction kicker, dipole and quadrupole magnets, and horn power supply connections (G2, G3, 288 Hours)
In-place testing of thirty (30) instances of power supplies with dummy loads (3B, 720 Hours)

WBS 1.1.4 Decay Region and Hadron Absorber

Scope: Installation of upstream and downstream decay pipe end caps. Installation of Hadron Absorber and shielding at downstream end of decay pipe.

Activities Requested for Designation as Noncovered Davis-Bacon:

Installation of upstream and downstream decay pipe end caps (G4, 40 Hours)
Sealing Hadron Absorber and its enclosure so as to control release of radioactivated air (G4, 96 Hours)
Final installation of "hand-stacked" radiation shielding around associated piping and cabling (G4, 40 Hours)
Installation of collection tank and drain piping for Hadron Absorber RAW secondary containment (G4, 40 Hours)

WBS 1.1.5 Neutrino Beam Monitoring

Scope: Installation and connection of Hadron Monitor at downstream end of Decay Pipe. Installation and connection of three Muon Monitors in muon alcoves downstream of the Hadron Absorber.

Activities Requested for Designation as Noncovered Davis-Bacon:

All activities associated with installation and connection of these four monitor systems (G4, G5, 5A, 360 Hours)

WBS 1.1.6 Survey, Alignment & Geodesy

Scope: Determine the Fermilab to Soudan line and align the center of the neutrino beam to the far MINOS detector in the Soudan mine with a tolerance budget of 12 meters. Place alignment monuments in underground enclosures and experimental caverns and tie to beamline. Align proton and neutrino beam elements. Check subcontractor determined locations at the Fermilab site during construction phase.

Activities Requested for Designation as Noncovered Davis-Bacon:

All services performed by the Fermilab Survey and Alignment Group (6A, 6, 412 Hours including 1,800 Hours for Fermilab construction QA and 800 Hours for Soudan)

WBS 1.1.7 Beamline Utilities

Scope: Various water systems including – Primary Beam LCW, Target & Baffle RAW, Horn 1 RAW, Horn 2 Raw, Intermediate Coling for Horn 1 & 2 RAW, Decay Pipe Cooling RAW, Hadron Absorber RAW, Intermediate Cooling for Hadron Absorber RAW, and MINOS LCW. Vacuum systems for primary beamline and decay pipe. Gas systems for primary beamline, total loss monitors and Hadron/Muon monitor instrumentation.

Activities Requested for Designation as Noncovered Davis-Bacon:

Hydrotesting of Primary Beam LCW and RAW Systems (7A, G4, 24 Hours)
Final installation and connection of LCW and RAW system instrumentation (G2, G4, 32 Hours)
Calibration and set-up of water pump motor controllers (G2, 16 Hours)
Connection of LCW hoses between headers and magnets (G2, 48 Hours)
Mechanical connection of pump skids, beam target module, horn modules, and Hadron Absorber modules to the RAW piping installed under SB&O subcontract (G3,G4, 96 Hours)
Installation and pre-commissioning of LCW and RAW control systems primarily consisting of Programmable Logic Controllers (G1, G2, 60 Hours)
Install and connect vacuum equipment in enclosure and equipment racks (G1, G2, 40 Hours)
Leak checking and bake-out activities (7B, 7C, 100 Hours)
Installation of gas connections for Total Loss Monitor cables (G4, 60 Hours)
Installation of manual gas system for Hadron and Muon Monitors, ref. WBS 1.1.5 (G5, 60 Hours)

WBS 1.1.8 Controls, Interlocks and Cable Installation

Scope: Installation of basic controls and networking infrastructure, FIRUS, and CATV systems. Installation of NuMI Radiation Safety System including critical device controllers and contactors, gates, barriers, door switches, door access controls, and radiation and environmental monitoring capability. Installation of all cables excepting beamline power supplies to loads. Cable terminations. NuMI Stub monorail installation and Target Hall shield door. Electrical modifications and additions to existing and new service buildings and enclosure areas.

Controls Activities Requested for Designation as Noncovered Davis-Bacon:

Installation of controls equipment in equipment racks (G1, 80 Hours)
Final placement of controls modules into various bus systems such as VME, NIM and CAMAC and final connection of controls cabling including fiber optic cables (G1, 80 Hours)
Connection of FIRUS and CATV equipment (G2, 8A, 50 Hours)
Development and placement of CATV systems to facilitate radioactive component handling in the Target Hall (G3, 2A, 8A, 64 Hours)

Interlock Activities Requested for Designation as Noncovered Davis-Bacon:

Terminate and connect safety system cables. Installation and alignment of selected components of the safety interlock system including selected gates and door switches. (G2, 8B, 200 Hours)

Cable Termination Activities Requested for Designation as Noncovered Davis-Bacon:

Termination of extraction kicker RG220 high voltage coaxial cables, Pirani vacuum gauge cables, and mass terminated cables (G3, 1A, 8C, 25 Hours)

Termination Andrew Heliax cables for 24 BPMs, 2 beam intensity toroids, and 4 total loss monitors (G4, 8D, 80 Hours)

WBS 2.5 Near Detector Installation

Scope: This WBS is responsible for the full installation of the MINOS near detector including temporary connections to utility services.

Activities Requested for Designation as Noncovered Davis-Bacon:

All activities associated with the installation and setup of the MINOS near detector experimental apparatus including detector and its magnet coil, LCW, magnet coil power supply and its cooling system (G5, 12,360 Hours)

Generalized Justifications for Noncovered Davis-Bacon Work Activities

DEAR 970.2204-1-1(a)(3) allows as noncovered work the assembly, modification, setup, installation, replacement, removal, rearrangement, connection, testing, adjustment, and calibration of machinery and equipment. This generalized allowance for noncovered work is reasoned to apply to the following NuMI Project activities.

G1 Installation, connection and setup of technical equipment in equipment racks. Examples of equipment in this category to be installed and connected include electronic crate systems such as VME, CAMAC, NIM, trim element power supply bins, and CIA and the modules inserted into same. Also included are multiplexed A/D converters (MADCs), oscilloscopes and test equipment, instrumentation processing electronics, device positioning systems, programmable logic controllers (PLCs), CATV monitors, ACNET consoles, network and controls signal repeaters, fiber optic cable field termination and routing enclosures. Also included here are the installation and connection of incidental inter-rack wiring and cabling within controls areas of service buildings and enclosure. Proper performance of the activity requires detailed and unique knowledge of the technical equipment and its relation to particular subsystems that are essential and unique to the accelerator complex and the neutrino beam system. While reasoned to fall under DEAR 970.2204-1-1(a)(3) exemptions, these activities are also best and reliably performed by Fermilab personnel.

G2 Field installation, connection and setup of other technical equipment. Examples of such activities include connection of LCW cooling hoses, cabling to beamline components such as magnets, kickers and trim elements, beam target, and focusing horns; and also to instrumentation such as hadron and muon monitors, CATV, FIRUS, water system transducers and process instrumentation, BPMs, beam intensity toroids, multiwires and loss monitors. While reasoned to fall under DEAR 970.2204-1-1(a)(3) exemptions, the proper performance of the activity is also essential and unique to correct operation of the equipment and are best and reliably performed by Fermilab personnel.

Other generalized justifications for noncovered Davis-Bacon work activities are as follows:

G3 Selected technical equipment scheduled for installation represents unusually high dollar value, uniqueness, first of a kind or state of the art designs, fragility, especially demanding placement tolerances, specialized installation skills, and less than readily available replacements or some combination thereof. Examples of such equipment include the three primary beam extraction kicker magnets, the beam target, the two magnetic focusing horns, the horn power supply, and the stripline connection between the horn power supply and the focusing horns. Proper installation of such equipment is readily categorized as mission critical and represents a material factor in the timely completion of the NuMI Project. The unique experience and technical qualifications of Fermilab personnel performing the work are demanded so as not to jeopardize the equipment, its availability, its proper functioning, its reliability, or the success of sub-system start-up.

G4 Selected areas of installation activities involve technical equipment or apparatus that will become highly radioactive once the neutrino beam system comes into operation. These activities demand an extremely high degree of care and attention to detail so as to preclude early failure of the equipment or apparatus, necessity of re-work or untimely repair. Examples include installation and connection of the beam target, magnetic focusing horns, RAW systems and containment structures, radioactive air containment systems, decay pipe end caps, hadron monitor detectors, and the beam Absorber. The installation of regular and total loss monitors in the primary beamline is related to this general category. Proper placement of these monitors is essential to minimizing radiological activation of components and groundwater. If such re-work or repair would be necessitated, the consequence would involve increased radiation exposure for workers and significant downtime to experimental operations. These activities often involve the direct involvement of radiation safety personnel. It is essential that such activities be reliably and successfully performed by experienced and qualified Fermilab personnel.

G5 The 980 metric ton near MINOS experimental detector is composed of iron-scintillator sandwich calorimeters, with toroidal magnetic fields in their thin steel plates. Specifically there are 282 iron-scintillator planes being comprised of 955 metric tons of steel and 25 tons of scintillator material. This combination has been used in a number of previous neutrino experiments. The MINOS innovation is to use scintillator with sufficiently fine transverse granularity so that it provides both calorimetry and tracking information. Inclusive with the experiment is the particle flux information afforded by both hadron and muon detector instrumentation in the Hadron Absorber area. This instrumentation, together with its associated data streams, is used by the near detector in conjunction with generated experimental data.

The fabrication and assembly of the MINOS near detector is clearly experimental apparatus and, as such, is not subject to the Davis-Bacon Act. The near detector is not a permanent part of the Laboratory's plant and property. There has been longstanding agreement between the Laboratory and the Department of Energy that such experimental related activities are noncovered. (Reference memorandum of August 22, 1972 from Fred C. Mattmueller, Area Manager, to Dr. Robert R. Wilson, Director)

Provisions for the construction of buildings, tunnels, and utilities, and modification of utility services for experimental purposes are recognized as covered activities. These activities are distinguished from those that involve temporary connections to the utility services and are noncovered. It is acknowledged, nonetheless, that certain post beneficial occupancy installation of temporary connections will likely be executed by non-Fermilab trade and craft personnel under subcontract to the Laboratory. These activities, involving approximately 900 hours of effort, will primarily involve finishing of electrical premises wiring, pipefitting and some welding.

Specific Justifications for Noncovered Davis-Bacon Work Activities by WBS

WBS 1.1.1 Primary Beam

1A Each of the three extraction kickers magnets each contain an especially long ceramic beam tube. Given that these tubes are no longer readily available from the past vendor, the tubes used have been salvaged from a very limited supply of excess equipment. In fact, there are only two such tubes remaining and they are of lesser quality in terms of aperture. These kickers are scheduled for installation in 2004 and providing replacement(s) in time for beam commissioning would be extremely difficult if not impossible. If any of these tubes would suffer damage during installation, there would be a major set back to the Project's schedule. It is essential that these elements be installed by Fermilab personnel familiar with the specialized techniques and handling procedures for such devices.

1B The transport of certain magnets in the Main Injector enclosure requires utilization of a custom built magnet mover. Operation of this magnet mover is limited to selected qualified Fermilab personnel.

1C A minority of magnetic elements in the primary beamline are supported from either the enclosure wall or ceiling. There has been long precedent for Fermilab personnel to load test such stands as both quality assurance of mounting method and as fulfillment of required safety tests. These load tests are best performed by independent Fermilab personnel.

1D Flourinert is used as a cooling fluid for the extraction kicker magnets. The system being installed is a first of a kind design for the Laboratory. Cooling of the flourinert fluid is a necessary process that serves to minimize the chemical breakdown of the fluid into dangerous compounds. Proper operation of the cooling system is essential in preventing damage to the extraction kicker magnets themselves. The proper mechanical installation of the flourinert cooling system is best accomplished by Fermilab personnel who have been involved with its development.

WBS 1.1.2 Neutrino Beam Devices

2A Development and practice of radioactive component handling is a scheduled activity in the Target Hall before beam commissioning. The Project anticipates failures of certain highly radioactive neutrino beam system components, notably the beam target and magnetic focusing horns. The handling, replacement, and possible repair of these highly radioactive components will be performed by specially qualified and knowledgeable Fermilab personnel. It is essential that they develop and practice related procedures so as to adequately and efficiently perform anticipated tasks with a minimum of personal radiological exposure. This exercise, that is practiced with the actual high value beamline chase components, may demand field modification of apparatus especially designed for the work on an as needed basis. These activities are reasoned to fall under DEAR 970.2204-1-1(a)(4) exemptions that allow as noncovered work the experimental development of equipment, processes, or devices including assembly, fitting, installation, testing, reworking, and disassembly.

WBS 1.1.3 Power Supplies

3A Various power supplies have been procured from available Fermilab spares. These supplies typically require some level of construction, modification or assembly so as to be suitable for operation. This work is often best accomplished at the place of final installation due to power supply size and/or lack of availability of other off Project site working space to perform the work. Such work is highly specialized and not normally performed by craft personnel. These activities are best performed by specially qualified and knowledgeable Fermilab personnel who are familiar with associated power supply technology.

3B Some of the required power supplies will be tested with dummy loads in-place on the Project site. This testing serves to validate supply design prior to the commissioning process. This testing activity is best performed by specially qualified and knowledgeable Fermilab personnel who are familiar with the associated power supply design and technology.

WBS 1.1.4 Decay Region and Hadron Absorber

No specific justifications are thought necessary for this WBS.

WBS 1.1.5 Neutrino Beam Monitoring

5A As mentioned in Generalized Justification G5, the hadron and muon detector systems designed and constructed under this WBS are considered as part of the experimental equipment. Installation activity is accordingly reasoned to be noncovered under Davis-Bacon.

WBS 1.1.6 Survey, Alignment & Geodesy

6A Alignment management, supervision, and actual field work during the alignment of technical components of the neutrino beam system is closely linked to the accelerator physics of the beamline, the experimental physics of both near and far MINOS detectors, the design of the alignment systems, and the as-built conditions of the enclosures. This alignment by its nature must be performed by professional personnel who understand the machine and experimental physics demands, component functions, alignment system design, alignment equipment limitations, and especially the data which represents the installed conditions in the enclosure.

Alignment of the neutrino beam system starts with the establishment of an overall control network which covers the entire geographical area of construction and installation. The design of this control network is based on the configuration of the neutrino beam system, the relationship to the Main Injector accelerator and the MINOS far detector, the placement of individual components in subunits, machine physics tolerances on component locations, and the capabilities of the equipment available to perform the actual alignment steps. This alignment equipment includes computer controlled electronic theodolites and laser distance measuring devices.

Machine physicists perform computer based beam optics/magnetic calculations which are the design criteria for the alignment personnel. Extensive parametric studies are performed on these beam optics calculations to determine the beamline lattice, component operating requirements, as well as component locations and their tolerances. During the design process, alignment personnel maintain a close interface with the beamline physicists to insure proper implementation of the beam optics design. The alignment personnel convert the beam optics computer output into "real" numbers to be used in the beamline. These numbers are determined relative to the control network designed by the alignment personnel. This process describes what can be called the "alignment design" which precedes installation and actual alignment work adjusting components in the enclosure.

During the actual installation/construction phase, alignment personnel will perform or supervise directly the following activities: installation of monuments in the enclosure floor or walls, surveying the surface network, surveying the enclosure control network, locating hardware supports, pre-aligning magnets and beam diagnostic equipment, and final alignment of the entire accelerator/storage ring complex. All these activities are driven by the beam optics requirements to locate many hundreds of components to tolerances that are typically within 0.010 inches. Relative location between selected components is often more stringent in tolerance. In the face of these requirements, alignment personnel must cope with fabrication tolerances on the machine components as well as conventional facilities that vary greatly. In the enclosure, some portions of concrete structures will move or settle significantly in the early years of the Project when installation occurs. Even after the enclosure is initially stabilized, it will continue to move as the beamline is commissioned and brought into operation.

Because of the conflict between the precision required for successful alignment of beamline components and the real environment of the beamline enclosure, it is essential that the alignment professionals oversee the installation of their alignment system, do the actual adjustments, and collect the alignment data in order to be able to interpret the conditions that exist in the beamline. Their environment is one of continuous iteration to achieve the final physics requirements of the beamline. Even temperature fluctuations in the enclosure can affect the accuracy of the alignment process. The physics requirements themselves are frequently not finalized until late in the construction phase. It would be extremely difficult, if not impossible to define the details of the beamline alignment so that it could be subcontracted, even if a lengthy training program for subcontract personnel were initiated. Frequently, the final alignment step in a beamline is the use of actual beam performance to adjust components to achieve proper beamline operation. Such a process is clearly envisioned for the neutrino beam system.

Finally, precision alignment and realignment will be a continuing process throughout the life of the MINOS experimental program. Over the years, settlement of some portions of the enclosure will occur and necessitate realignment. Any future modifications to the neutrino beam system will require alignment to existing components.

The particular requirements of survey and alignment activities demanded by the NuMI Project, as outlined above, are best executed by Fermilab personnel uniquely familiar with the activities required.

WBS 1.1.7 Beamline Utilities

7A Hydro testing of both LCW and RAW systems is common practice to verify acceptance of subcontractor work. Water cooling is an essential utility that affords proper operation of varied technical components, some of which are of especially high value. RAW systems are especially critical given the potential for radioactivated fluid release. Care must be taken in the testing activity to isolate selected devices that may be damaged by the test. Hydro testing of installed water systems is best performed by independent Fermilab personnel who have experience in this type of testing procedure and who are knowledgeable in the particular design of the system under test.

7B Various vacuum systems and especially the primary beam vacuum system are acceptance tested by performing a helium leak check in accordance with standard Fermilab leak check techniques and by qualified Fermilab vacuum technicians. The integrity of welds and mechanical connections are verified. The highly specialized testing equipment required would not normally be available to construction contractors but is currently part of the complement of Laboratory property. Likewise, helium leak checking techniques would not normally be included in the range of skills of construction contractor personnel but are a normal requirement of Fermilab vacuum personnel. Testing vacuum systems for leaks using helium detection techniques are best performed by uniquely trained and qualified Fermilab personnel.

7C Selected primary beamline components, especially including the Lambertson magnets, require bakeout at elevated temperatures to achieve desired levels of operating vacuum. Successful bakeouts require careful attention to the process and monitor of the vacuum system during the bake. Such activities are successfully and best executed by qualified Fermilab vacuum technicians.

WBS 1.1.8 Controls, Interlocks and Cable Installation

8A The FIRUS system, unique to Fermilab, involves installation of specialized equipment that serves to monitor remote fire detection systems for life safety and critical utilities. The CATV system is also unique in it layout and distribution. Certain aspects of the CATV installation will involve life safety by monitoring conditions in the underground enclosures. Installation must also take into account signal and amplifier levels for proper operation. Installation activities associated with these systems are best performed by qualified Fermilab personnel familiar with these systems.

8B Much of the modifications and installation relating to the Main Injector and NuMI Radiation Safety Systems is provided by electrician craft personnel by conduit placement and cable pulling. Termination and connection of safety system cables, installation and alignment of selected components of the safety interlock system, connection of critical devices, and placement and alignment of selected gates and door switches are unique activities best performed by Fermilab personnel familiar with the design and proper installation techniques. This work is extremely critical to the proper operation of the Radiation Safety Systems and has a strong life safety component. Work on these systems is procedurally limited to specific Interlock Group personnel in the Beam Division's ES&H Department.

8C Terminations for a select group of cables require specialized connectors and/or tooling. Proper termination of the RG220 high voltage cables for the extraction kickers involves phase matching (ref. 8D) is especially important given the uniqueness and criticality of the extraction kickers themselves. These termination activities, while not represented by a great number of hours of work, are best performed by Fermilab personnel practiced in appropriate techniques.

8D Termination of some 54 Andrew Heliax cables is not an easy or straightforward task. This is a specialized activity best performed by Fermilab personnel familiar with developed techniques and procedures. Proper operation of BPMs, and the intensity and total loss monitors is essential to proper and safe operation of the primary beam line. Additionally, the two cables per BPM must be trimmed and cut so as to have exactly similar electrical lengths. This task requires the use of specialized electronic measuring equipment to achieve this characteristic. Subcontractors generally do not have the personnel with the required electronic skill level or the advanced electronic equipment to accomplish the task. Incorrect termination could cause system errors that could result in false readings of actual beam position.

WBS 2.5 Near Detector Installation

No specific justifications are thought necessary for this WBS.

Summary of Covered and Noncovered Davis-Bacon Effort for the NuMI Project

Civil Construction

WBS	Subcontract Activity	DB Covered Hours (Actual or Est)	Requested Noncovered Hours
1.2	Site Prep	3,964	0
	Tunnels & Halls	835,623	
	Service Buildings and Outfitting	82,000	
Sub Totals		921,587	0

Technical Component Installation

WBS	Value of DB Installation Subcontracts	Converted to DB Covered Hours	Requested Noncovered Hours
1.1.1	$278,693	5,067	968
1.1.2	$666,957	12,126	1,702
1.1.3	$152,473	2,772	1,728
1.1.4	$227,525	4,137	216
1.1.7	$242,340	4,406	536
1.1.8	$545,755	9,923	499
Sub Totals	$2,113,743	38,432	5,649

Survey Alignment and Geodesy

WBS	Area of Activity	Fermilab SAG Hours	Requested Noncovered Hours
1.1.6	Construction QA	1,800	1,800
	Installation Including MINOS Near Detector	3,812	3,812
Sub Totals		5,612	5,612

MINOS Near Detector Installation

WBS	Value of DB Installation Subcontracts	Converted to DB Covered Hours	Requested Noncovered Hours
1.1.5	$5,280	96	360
2.5	$49,500	900	12,360
Sub Totals	$54,780	996	12,720

Total DB Covered Hours	961,015
Total Requested Noncovered Hours	23,981

All Dollar Amounts Are FY98$. DB Installation Subcontracts Valued at $55 per Hour.

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